IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:	Confirmation No.: 1122
Ian David Manger et al.	Examiner: Paul Sang Hwa Hyun
Application No.: 10/602,489	Art Unit: 1772
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For: RECIRCULATING FLUIDIC NETWORK AND METHODS FOR USING THE SAME	
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Applicant notes that claim 14 recites:

14. A method of conducting a binding assay, comprising:

(a) providing a microfluidic device comprising a solid substrate layer having a surface that is capable of attaching ligand and/or anti-ligand, and an elastomeric layer attached to said solid substrate surface, wherein said elastomeric layer comprises:

(i) a plurality of first flow channels;

(ii) a plurality of second flow channels each intersecting and crossing each of the first flow channels thereby providing a plurality of intersecting areas formed at intersections between the first flow channels and the second flow channels, wherein the plurality of first flow channels and the plurality of second flow channels are adapted to allow the flow of a solution therethrough, wherein the solid substrate surface is in fluid communication with at least the intersecting areas of the plurality of first flow channels and the plurality of second flow channels, and wherein the plurality of first flow channels and/or the plurality of second flow channels are capable of forming a plurality of closed looped flow channels, wherein the plurality of second flow channels are in communication with a pump, and wherein a sample solution is transported through the plurality of second flow channels under the action of the pump, wherein the pump comprises more than one control channel each formed within the elastomeric layer and separated from the plurality of second flow channels by an elastomeric segment that is deflectable into the

plurality of second flow channels in response to an actuation force, whereby the sample solution is transported along the plurality of second flow channels upon independent, sequential actuation of the more than one control channels;

(iii) a plurality of control channels;

(iv) a plurality of first control valves each operatively disposed with respect to each of the first flow channels to regulate flow of the solution through the first flow channels, wherein each of the first control valves comprises a first control channel and an elastomeric segment that is deflectable into or retractable from the first flow channel upon which the first control valve operates in response to an actuation force applied to the first control channel, the elastomeric segment when positioned in the first flow channel restricting solution flow therethrough;

(v) a plurality of second control valves each operatively disposed with respect to each of the second flow channels to regulate flow of the solution through the second flow channels, wherein each of the second control valves comprises a second control channel and an elastomeric segment that is deflectable into or retractable from the second flow channel upon which the second control valve operates in response to an actuation force applied to the second control channel, the elastomeric segment when positioned in the second flow channel restricting solution flow therethrough;

(vi) a plurality of sets of closed loop forming control valves each set having a first valve operatively disposed with respect to an inlet of one of each of the first and/or the second flow channels and a second valve operatively disposed with respect to an outlet of one of each of the first and/or second flow channels to form the plurality of closed looped flow channels, wherein each of the loop forming control valves comprises a loop forming control channel and an elastomeric segment that is deflectable into or retractable from the first and/or the second flow channels upon which the loop forming control valve operates in response to an actuation force applied to the loop forming control channel, the elastomeric segment when positioned in the first and/or the second flow channels restricting solution flow therethrough thereby forming the looped flow channel, wherein the first valve of the set of loop forming control valves comprises a control channel of the pump that is independently actuated with respect to other control channels of the pump; and

(vii) a plurality of recirculating pumps, and wherein each recirculating pump is operatively disposed with respect to one of the closed looped flow channels such that circulation

of solution through each of the closed looped flow channels can be regulated by one of the recirculating pumps;

(b) applying an actuating force to the second control valves to restrict solution flow through each of the second flow channels;

(c) introducing a reagent comprising a ligand into at least one of the first flow channels under conditions sufficient to attach the ligand to the solid substrate surface;

(d) removing the actuation force to the second flow channel control channel and applying an actuation force to the first control channel such that solution flow through the first flow channel is restricted; and

(e) performing a binding assay by introducing the sample solution into the second flow channel;

(f) applying an actuating force from two control lines to the plurality of sets of closed loop forming control valves to form the plurality of closed looped flow channels such that each closed looped flow channel comprises a closed loop spanning multiple rows and multiple columns; and recirculating the sample solution within the closed loop each of the closed looped flow channels using the recirculating pump under conditions sufficient to specifically bind an anti-ligand that may be present in the sample solution to the ligand that is attached to the solid substrate surface; and

(g) detecting the binding of the anti-ligand in the sample to the ligand.

Applicant notes that claim 34 recites:

34. A method of conducting a binding assay, comprising:

(a) providing a microfluidic device comprising a solid substrate layer having a surface that is capable of attaching ligand and/or anti-ligand, and an elastomeric layer attached to said solid substrate surface, wherein said elastomeric layer comprises:

(i) a first flow channel;

(ii) a second flow channel intersecting and crossing the first flow channel thereby providing an intersecting area formed at an intersection between the first flow channel and the second flow channel, wherein the first flow channel and the second flow channel are adapted to allow the flow of a solution therethrough, wherein the solid substrate surface is in fluid communication with at least the intersecting area of the first flow channel and the second flow channel, and wherein the first flow channel and/or the second flow channel are capable of

forming a closed looped flow channel, wherein the second flow channel is in communication with a pump, and wherein a sample solution is transported through the second flow channel under the action of the pump, wherein the pump comprises more than one control channel each formed within the elastomeric layer and separated from the second flow channel by an elastomeric segment that is deflectable into the second flow channel in response to an actuation force, whereby the sample solution is transported along the second flow channel upon independent, sequential actuation of the more than one control channels;

(iii) a plurality of control channels;

(iv) a first control valve operatively disposed with respect to the first flow channel to regulate flow of the solution through the first flow channel, wherein the first control valve comprises a first control channel and an elastomeric segment that is deflectable into or retractable from the first flow channel upon which the first control valve operates in response to an actuation force applied to the first control channel, the elastomeric segment when positioned in the first flow channel restricting solution flow therethrough;

(v) a second control valve operatively disposed with respect to the second flow channel to regulate flow of the solution through the second flow channel, wherein the second control valve comprises a second control channel and an elastomeric segment that is deflectable into or retractable from the second flow channel upon which the second control valve operates in response to an actuation force applied to the second control channel, the elastomeric segment when positioned in the second flow channel restricting solution flow therethrough;

(vi) a first loop forming control valve operatively disposed with respect to an inlet of one of the first and/or the second flow channels and a second loop forming control valve operatively disposed with respect to an outlet of one of the first and/or second flow channels to form the closed looped flow channel, wherein each of the first and second loop forming control valves comprises a loop forming control channel and an elastomeric segment that is deflectable into or retractable from the first and/or the second flow channels upon which the loop forming control valve operates in response to an actuation force applied to the loop forming control channel, the elastomeric segment when positioned in the first and/or the second flow channels restricting solution flow therethrough thereby forming the closed looped flow channel, wherein the first loop forming control valve comprises a control channel of the pump that is independently actuated with respect to other control channels of the pump; and

(vii) a recirculating pump operatively disposed with respect to the closed looped flow channel such that circulation of solution through the closed looped flow channel can be regulated by the recirculating pump;

(b) applying an actuating force to the second control valve to restrict solution flow through the second flow channel;

(c) introducing a reagent comprising a ligand into the first flow channel under conditions sufficient to attach the ligand to the solid substrate surface;

(d) removing the actuation force to the second flow channel control channel and applying an actuation force to the first control channel such that solution flow through the first flow channel is restricted; and

(e) performing a binding assay by introducing a sample solution into the second flow channel;

(f) applying an actuating force to the first loop forming control valve using a first control line and to the second loop forming control valve using a second control line to form the closed looped flow channel such that the closed looped flow channel comprises a closed loop; and recirculating the sample solution within the closed loop of the closed looped flow channel using the recirculating pump under conditions sufficient to specifically bind an anti-ligand that may be present in the sample solution to the ligand that is attached to the solid substrate surface; and

(g) detecting the binding of the anti-ligand in the sample to the ligand.

None of the prior art references teach or suggest methods or systems as recited in any of these claims.

Respectfully submitted,

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